

**OPHIOOTHRIX SYNOECINA NEW SPECIES
(ECHINODERMATA: OPHIUROIDEA) FROM THE
CARIBBEAN COAST OF COLOMBIA**

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ABSTRACT

A new species, *Ophiothrix synoecina*, is described and figured. *O. synoecina* differs from its Caribbean congeners in spination of disk and arms and in its color pattern. The disk of *O. synoecina* bears short, stout stumps, the arm spines are flattened and uniform denticulated. Some individuals are dark blue-grey, others have banded arms. *O. synoecina* is an obligate associate of the regular sea urchin *Echinometra lucunter* (L.) in the area of Santa Marta on the Caribbean coast of Colombia. The rock-boring echinometrid *E. lucunter* inhabits heavily exposed areas of rocky shores. *O. synoecina* lives in the boreholes excavated by the sea urchin, spending its life under the echinoid.

Ophiothrix synoecina new species brings to eight the number of *Ophiothrix* species reported from the Caribbean: *O. angulata* (Say), *O. brachyactis* H. L. Clark, *O. hartfordi* A. H. Clark, *O. lineata* Lyman, *O. oerstedi* Lütken *O. platyactis* H. L. Clark, *O. suensonii* Lütken. Some of them are known to live in association with other invertebrates. *O. lineata* lives in close association with the sponge *Callyspongia vaginalis* (Lamarck) (Hendler, 1984). *O. suensonii* is regularly found on corals, especially gorgonians (H. L. Clark, 1933; de Roa, 1967), and sponges (Devaney, 1973; S. S., pers. obs.). *O. oerstedi* can be found in similar habitats as the previous species (Devaney, 1973; de Roa, 1967) as well as under rubble (Hendler, pers. comm.). *O. synoecina*, is an obligate associate of the sea urchin *Echinometra lucunter* (L.). Living in its burrows, the brittle star receives shelter from predators and wave action. The association of *O. synoecina* with the echinoid as well as the biology, ecology and development of the species have been documented by Schoppe (1990, 1991, 1993; Schoppe and Holl, 1994 and Schoppe and Werding (in press)). The present paper describes the taxonomy of *Ophiothrix synoecina*.

METHODS

The work is based on collections which were made between November 1988 and May 1989, and between September 1990 and February 1993 on the Caribbean coast of Colombia, near Santa Marta. The area and tides, sea temperature, and salinity are described by Brattström (1980), Wedler (1975) and Salzwedel and Müller (1983) respectively.

The following abbreviations are used in this paper: dd: disk diameter; arm segments in Roman numerals. SMF: Naturmuseum Senckenberg, Frankfurt a.M.; LACM: Natural History Museum of Los Angeles County; INVEMAR: Instituto de Investigaciones Marinas de Punta de Betín.

SYSTEMATIC ACCOUNT

Family Ophiotrichidae

Genus *Ophiothrix* Müller and Troschel, 1840

Ophiothrix synoecina, new species

Figures 1–8

Ophiothrix sp.: Manjarrés, 1984: 80; Schoppe, 1990: 1–68, fig. 10; Schoppe, 1991: 373–379; Schoppe, 1994: 107.

Ophiothrix n. sp.: Schoppe, 1993: 1–122, fig. 13, 14, 27, 34; Schoppe and Holl, 1994.

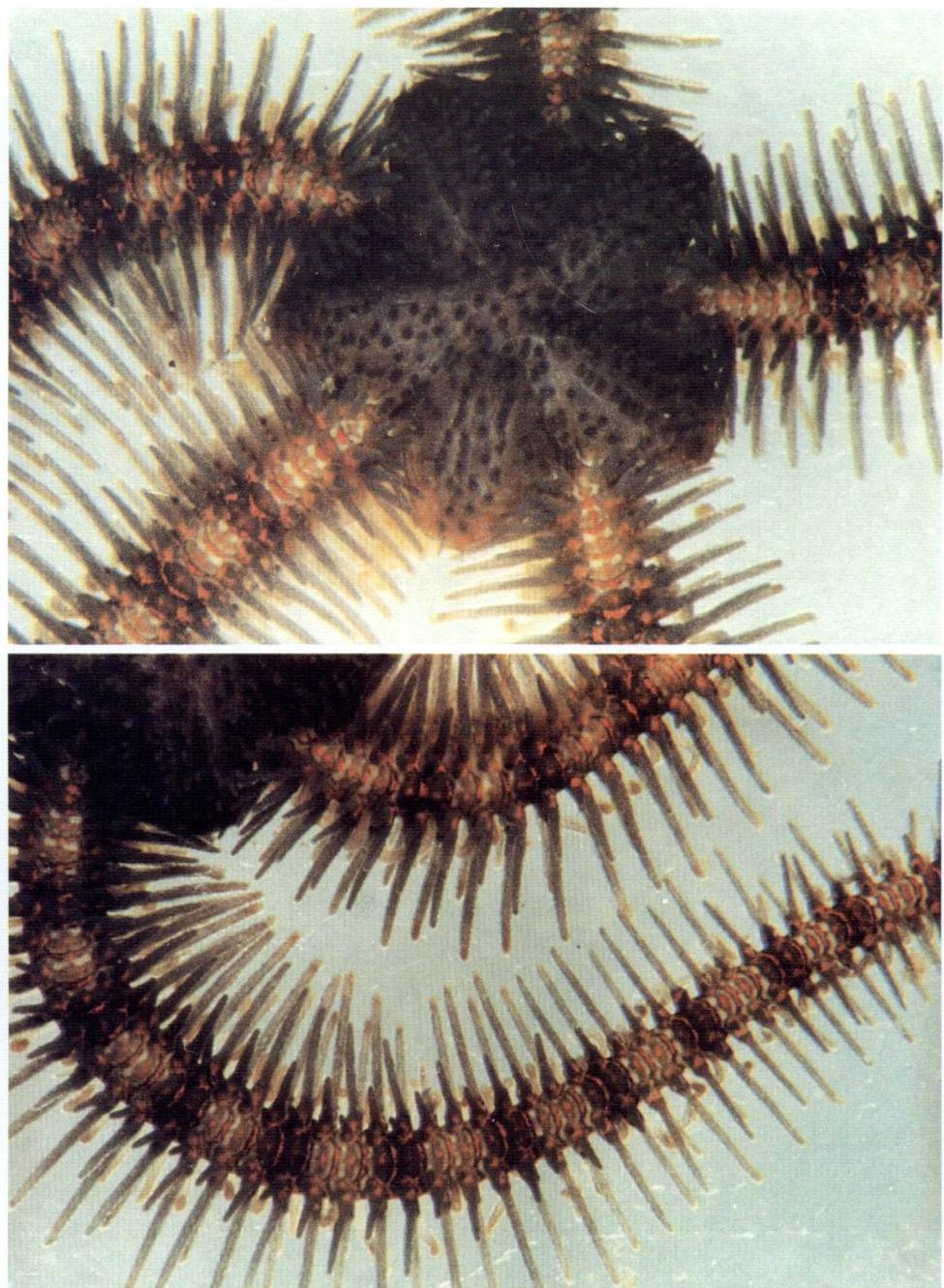


Figure 1. (upper) *Ophiothrix synoecina*: disc with arm base, dorsal view, 15 \times .

Figure 2. (lower) *Ophiothrix synoecina*: portion of disc with arms, dorsal view, dark banded colour pattern, 15 \times .

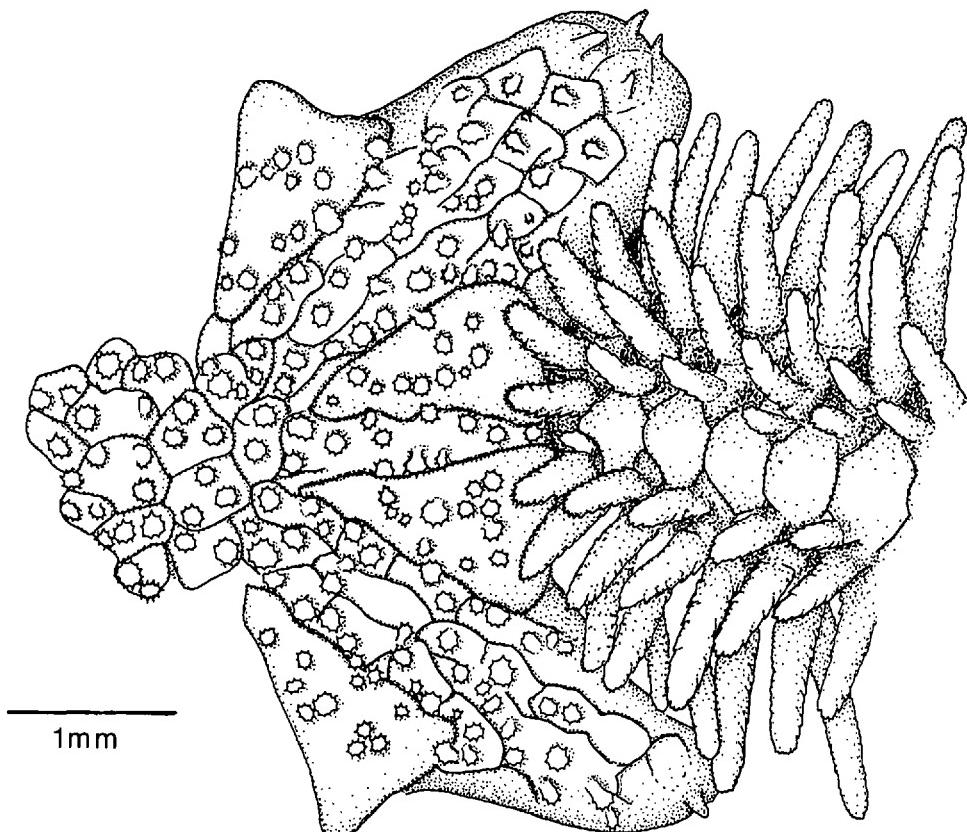


Figure 3. *Ophiothrix synoecina*, holotype SMF 1600: portion of disc with arm base, dorsal view.

Material Examined.—All specimens were collected by the author from the boreholes of the sea urchin *Echinometra lucunter*, exposed rocky intertidal, region of Santa Marta, Department Magdalena, COLOMBIA ($11^{\circ}12'N$, $74^{\circ}06'W$). Holotype (SMF 1600) collected April 16, 1991, Granate, Tayrona Park (treated with neutral-red). 8 paratypes (LACM 91-202.1) collected April 16, 1991, Granate, Tayrona Park; 1 paratype (LACM 90-395.1) collected Nov. 10, 1990, Punta de Betín, Santa Marta. 1 paratype (SMF 1601) collected April 3, 1989, Granate, Tayrona Park (dried specimen), 15 paratypes (SMF 1602) collected May 2, 1991, Isla Morro Grande. Non-type material in INVEMAR and in the author's collection.

Etymology.—The specific epithet is derived from the Greek words *syn*, “together” and *oīkos*, “dwelling, house,” referring to the association of the brittle star with the sea urchin and its borehole.

Diagnosis.—Disk flattened with a somewhat pentagonal shape, with outpouchings between arms; up to 7.0 mm in diameter. Radial shields and dorsal disk plates bear short, stout stumps, each with about 5–20 thorns at the top. Slender spines lacking. Each jaw with 3–4 teeth. Arms short, 3–5 times the dd. Dorsal arm plates rhombic to fan-shaped; upper surface with slight keel. Ventral arm plates quadrangular. Spines on first arm segment form almost continuous series across top of arm; dorsalmost spines on succeeding joints more widely spaced. Dorsal-most spine very short, less than 0.5 the arm segment's length, tip rounded. All spines somewhat flattened, tips blunt and sometimes slightly expanded, spines uniformly

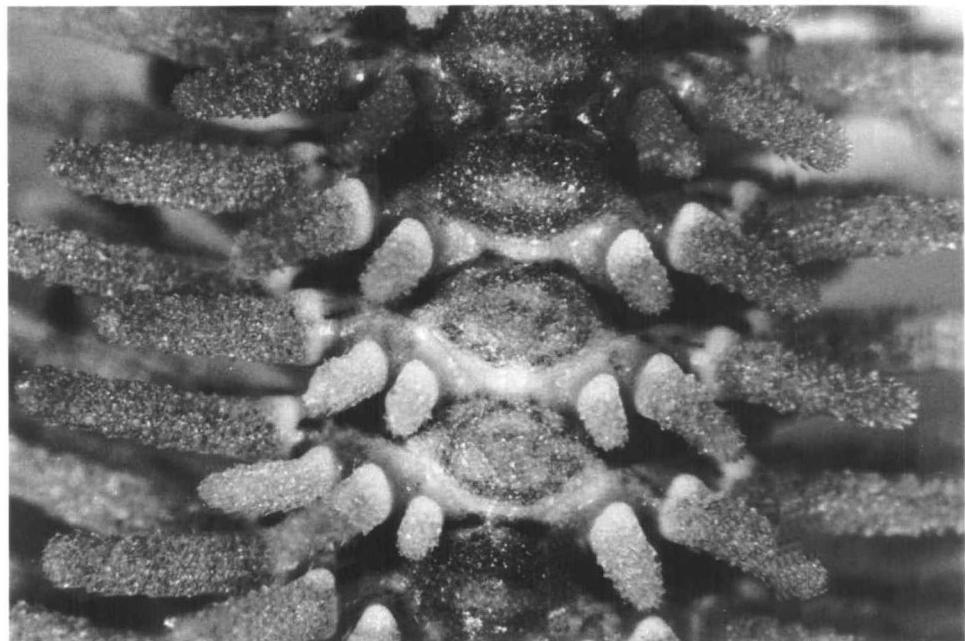


Figure 4. *Ophiothrix synoecina*, holotype SMF 1600: dorsal arm plates IV–VII, 46 \times .

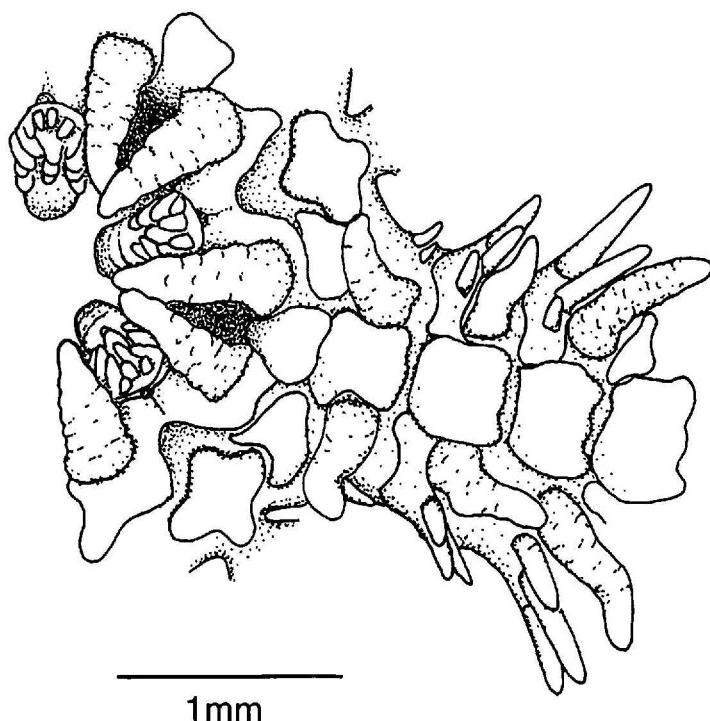


Figure 5. *Ophiothrix synoecina*, holotype SMF 1600: portion of disc with arm base, ventral view.

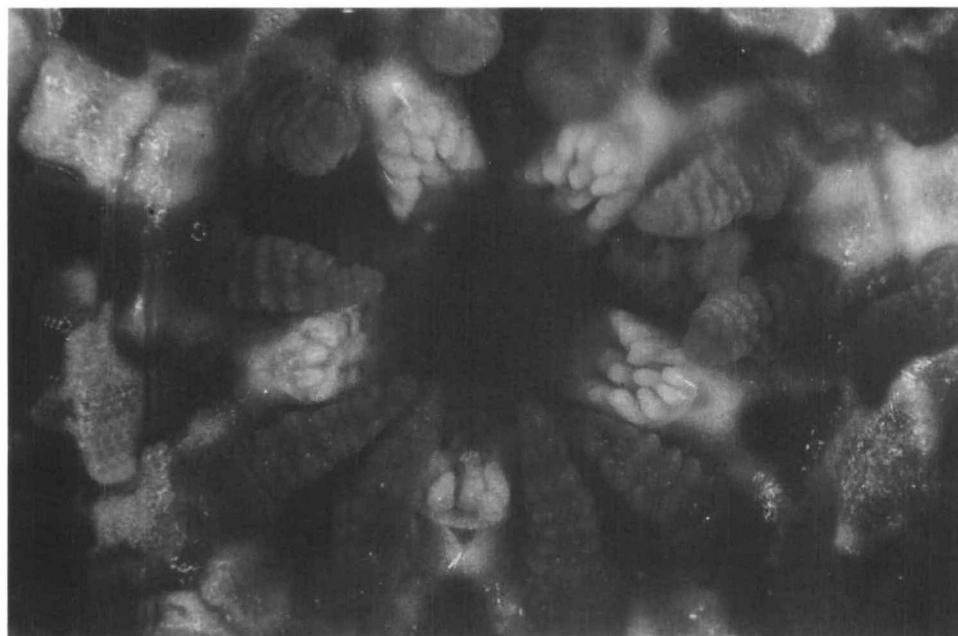


Figure 6. *Ophiothrix synoecina*, holotype SMF 1600: central portion of disc, ventral view, 46 \times .

denticulate. Longest arm spine approximately 4 times the arm segment's length. Ventralmost arm spine on distal half of arm hooked.

Description of Holotype.—Female, with disk diameter 6.5 mm. Disk integument obscures edges of plates and scales. Radial shields large, 0.22 of dd (0.75 mm wide and 1.4 mm long); each pair separated by scales bearing rounded stumps. Interradial areas with 2–3 irregular rows of thin scales bearing stout, spiny stumps. Length of stumps 0.1–0.16 mm, maximum diameter 0.16 mm. Stumps with rather smooth stem and a thorny rounded tip, the large stumps with more than 20 minute thorns. Stumps more slender on lateral margin of the disk. Oral shield rhombic with rounded edges, 1.33 broader than long, with margins concave. Madreporite with convex margins, 1.25 broader than long. Adoral plates proximally not in contact, rectangular adradial edge adjoining first ventral arm plate and separating it from oral shield. Each jaw with about 17 dental papillae arranged in three rows, dorsalmost largest, and three teeth. Teeth with straight, broad, hyaline proximal edge. Ventral interradial plates of disk naked, only at periphery bearing some rounded scales, each of them carrying a slender stump.

Arms about three to four times the dd. Dorsal arm plates with slight keel, basal ones rhombic; distal ones fan-shaped. Ventral arm plates subquadangular, with concave lateral and distal margins, successive plates separated by tissue-filled area. Second ventral arm plate almost as long as wide; following plates wider than long becoming squarish, then longer than wide at the tip of the arm. Tentacle pores large. A minute tentacle scale present from segment III–IV and onward. Tube feet with numerous papillae. Number of arm spines, from segment I to XII: 2, 4, 4, 11, 10, 9, 9, 8, 9, 8, 8, 8. Arm spines somewhat flattened, with tips rounded, blunt and sometimes slightly expanded, evenly thorny. Dorsalmost spine very short, its length no more than 2–3 the spine's diameter, and less than the

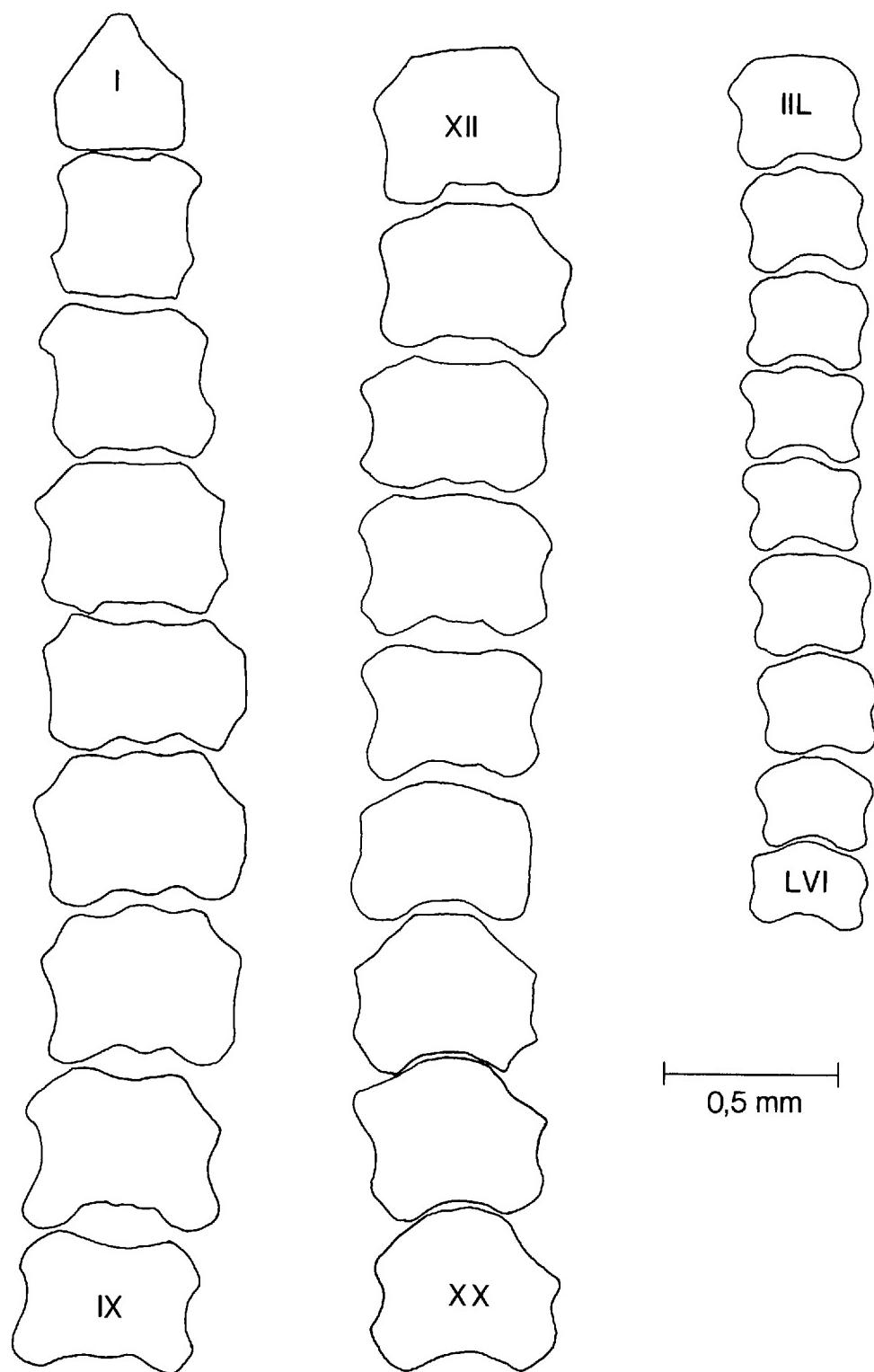


Figure 7. *Ophiothrix synoecina*, holotype SMF 1600: ventral arm plates I–XI, XII–XX, and III–LVI.

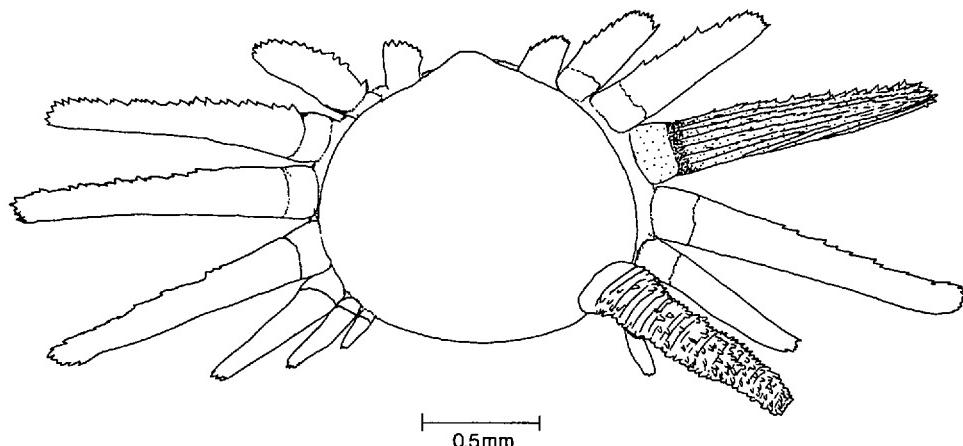


Figure 8. *Ophiothrix synoecina*, holotype SMF 1600: cross section of arm, segment VI.

arm segment's length. Arm spines increasing in length ventrally. Fourth and more distally third spine from aboral side longest, equalling approximately four times the arm segment's length. Basal 3–4 free arm segments with longest arm spine no more than three times the segment's length; successive arm segments with lateral arm spines wider at tip than at base. Distal arm segments with the spines most flattened, and a denticulation more obvious than on the stout basal arm spines. Ventralmost arm spine less than half the segment's length. On distal half of the arms, ventral spine hook-shaped with two teeth, at the arm tip as long or even longer than the segment's length.

Color in life is a light banded pattern. Disk bluish-grey, distal part of interradial areas whitish-grey. Scales between each pair of radial shields whitish. Center of the disk whitish. Arms banded, proximal segment whitish, followed by two greyish-blue, followed by two whitish etc. Arm spines in dorsal view greyish-blue, in ventral view whitish. Tube feet whitish with grey tips. Ventral surface cream colored.

Variation.—Paratype (LACM 90-395.1) is a male specimen of 2.7 mm dd and a maximum arm length of 8.0 mm. It has a conspicuous large central plate with only a few stumps at the margins. Dorsal plates, scales, and radial shields bear short stumps, each crowned with 5–10 thorns. Radial shields 1.0 mm wide and 1.3–1.8 mm long. Arms about three times the disk diameter. Dorsal arm plates rhombic, then fan-shaped. Ventral arm plates quadrangular. Tentacle scale present from segment V onward. Number of arm spines on segment I–XII: 2, 4, 7, 7, 6, 6, 6, 5, 6, 6, 5, 5. Dorsal and lateral arm spines ovate in cross-section, conspicuously wide, with a denticulation more obvious than in larger specimens. Dorsalmost arm spine less than half the segment's length. Longest arm spine, the third from above, about 2.5 longer than the arm segment. From arm segment VIII onward ventral spine hook-shaped with two teeth. Color of disk bluish-grey (light banded pattern) with star-shaped white color pattern in the centre.

JUVENILES. Disk diameter 0.25–0.3 mm, with very large pentagonal central plate, at periphery five minute trifid stumps. Arms with two segments and a very short, cylindrical terminal plate. First arm segment with two short spines, dorsal spine slightly shorter than lateral one. Second arm segment with small, conical dorsal spine and conspicuous two-toothed, hook-shaped ventral spine.

COLOR. Three different color patterns can be distinguished in live specimens: LIGHT BANDED PATTERN. See holotype. DARK BANDED PATTERN. Disk red-orange, with bluish-black spots or patterns in the center. Arms banded reddish, blue, and white. Proximal four segments have a pattern of white and red, following two segments blue with red spots, followed by two and one half segments of the preceding type etc. Dorsal arm spines bluish, tube feet whitish. Ventral surface cream colored. And UNIFORM DARK PATTERN. Disk and arms bluish-black, ventral surface cream colored. Specimens preserved in alcohol retain colors, except the red shades, for a long time. Dried specimens lose color relatively quickly.

Biology.—*Ophiothrix synoecina* is a protandric hermaphrodite (Schoppe and Holl, in press). Mature females brood their embryos externally (Schoppe, 1993). Consequently, *Ophiothrix synoecina* is the first member of the genus that is a protandric hermaphrodite with direct development. External brooding is only known for one other ophiuroid species, *Ophiophycis gracilis* (Mortensen, 1933).

Ophiothrix synoecina has been exclusively found in the boreholes of the rock-boring sea urchin *Echinometra lucunter* in the area of Santa Marta (11°12'N, 74°06'W), Caribbean coast of Colombia. The boreholes correspond in size to that of the sea urchin, which attains a test diameter of 6.6 cm in the investigated area. The borings are restricted to the exposed rocky intertidal down to a depth of 4 m, where population densities up to 89 sea urchins per square meter were found. Between 73.0 and 91.5% (mean 79%) of the dwellings were occupied by *O. synoecina*. Up to 10 individuals were found in one borehole. *O. synoecina* conceals itself under the echinoid. The brittle star benefits from the cohabitation by receiving shelter from wave action and predators. The brittle star appears to be obligatorily associated with the sea urchin.

Remarks.—*Ophiothrix synoecina* can be easily distinguished from its Caribbean congeners as follows: It differs from *O. angulata*, *O. lineata*, *O. platyactis* and *O. suensonii* in lacking longitudinal strips, and from *O. oerstedi* in lacking regular transversal white or yellowish lines on dorsal side of arms. The new species most resembles to *O. brachyactis* and *O. hartfordi*. All three species are bluish-grey and have relatively short arms. *O. synoecina* can be distinguished from *O. brachyactis* in having the radial shields beset with short, stout stumps; whereas the radials shields of *O. brachyactis* are bare. The stumps on the disk of *O. synoecina* are stout and have 5–20 thorns at their rounded tip; those of *O. brachyactis* have several (up to 10) sharp glassy points. The lateral arm spines of *O. synoecina* increase in length from the proximal to the VI segment; whereas *O. brachyactis* has arm spines almost equal in length in the basal part of the arm, while distally they slightly decrease in length. The dorsal arm spines of *O. synoecina* have a uniform denticulation, while the spines of *O. brachyactis* bear scattered, rather coarse glassy spinules. Smaller specimens are more difficult to distinguish. Different features between *O. synoecina* and *O. hartfordi* are even more difficult to find. According to the description of *O. hartfordi* by A. H. Clark (1939), which is based on a single specimen, the only definite difference between the two species lies in the coloration of the spines. While the spines of *O. synoecina* are always colored (greyish blue or bluish), those of *O. hartfordi* are white. Other slight variations between the species such as the number of disk stumps or arm spines might be due to differences in size of the specimens.

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LITERATURE CITED

- Brattström, H. 1980. Rocky shore zonation in the Santa Marta area, Colombia. *Sarsia* 65: 163–226.
- Clark, A. H. 1939. Echinoderms of the Smithsonian-Hartford Expedition, 1937, with other West Indian records. *Proc. U.S. Nat. Mus.* 86: 441–456.
- Clark, H. L., 1933. A handbook of the littoral echinoderms of Porto Rico and other West Indian Islands. *Sci. Sur., Porto Rico and Virgin Isl.* 16: 1–147.
- de Roa, E. Z., 1967. Contribución al estudio de los equinodermos de Venezuela. *Acta Biol. Venezuel.* 5: 267–333.
- Devaney, D. M. 1973. Shallow-water echinoderms from British Honduras, with a description of a new species of *Ophiocoma* (Ophiuroidea). *Bull. Mar. Sci.* 24: 122–164.
- Hendler, G. 1984. The association of *Ophiothrix lineata* and *Callyspongia vaginalis*: a brittlestar-sponge cleaning symbiosis? *P.S.Z.N.I.: Marine Ecology* 5: 9–27.
- Manjarrés, G. 1984. Estructura de la macrofauna bentica del litoral rocoso en la región de Santa Marta. Tesis de grado, Universidad Nacional de Colombia, 117 p.
- Mortensen, T. 1933. Papers from Dr. Th. Mortensen's Pacific Expedition. 1914–16. LXVI. The echinoderms of St. Helena. (other than crinoids). *Vidensk. Medd. Dansk. Naturhist. Foren. København* 93: 401–473.
- Müller, J. and F. H. Troschel. 1840. Ueber die Gattungen der Ophiuren. *Arch. Naturgesch.* 6(1): 327–330.
- Salzwedel, H. and K. Müller. 1983. A summary of meteorological and hydrological data from the bay of Santa Marta, Colombian Caribbean. *An. Inst. Inv. Mar. Punta de Betín* 13: 67–83.
- Schoppe, S. 1990. Die Vergesellschaftung zwischen *Acyrtus rubiginosus* (Gobiesocidae), *Clastotoechus vanderhorsti* (Porcellanidae), *Ophiothrix* sp. (Ophiotrichidae) und ihrem gesteinbohrenden Wirt *Echinometra lucunter* (Echinometridae) im Felslitoral von Santa Marta, Kolumbien. M.Sc. Thesis, Justus-Liebig University, Giessen, Germany. 68 p.
- . 1991. *Echinometra lucunter* (Linnaeus) (Echinoidea, Echinometridae) als Wirt einer komplexen Lebensgemeinschaft im Karibischen Meer. *Helgoländer Meeresunters.* 45: 373–379.
- . 1993. Die Karpose um den felsbohrenden Seeigel *Echinometra lucunter* (L.): Untersuchung der Lebensraumbedingungen und der Biologie der assoziierten Arten. Dissertation, Justus-Liebig University, Giessen, Germany, 128 p.
- . 1994. Larval development of *Clastotoechus vanderhorsti* (Schmitt, 1924) (Decapoda, Porcellanidae). *Ophelia* 39: 107–119.
- . and A. Holl. 1994. *Ophiothrix* n. sp. (Echinodermata: Ophiotrichidae) from Colombia, a protandric hermaphrodite that broods its young. Pages 471–475 in: David, Guille, Féral and Roux (eds) *Echinoderms through Time*. A. A. Balkema, Rotterdam.
- . and B. Werdung. In press. The boreholes of the sea urchin genus *Echinometra* (Echinodermata: Echinoidea: Echinometridae) as microhabitat in tropical South America. *P.S.Z.N.I.: Marine Ecology*.
- Wedder, E. 1975. Ökologische Untersuchungen an Hydroiden des Felslitorals von Santa Marta (Kolumbien). *Helgoländer Wiss. Meeresunters.* 27: 324–363.

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